# *Yellow-billed Cuckoo South Fork Kern River Valley 2016 Annual Report*

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## *Table of Contents*



## *List of Tables*



## *List of Maps*



## *List of Figures*

## *Executive Summary*

Following the dramatic loss of riparian forest habitat over the last century, the western distinct population segment of the yellow-billed cuckoo (*Coccyzus americanus*) declined significantly and experienced concurrent extirpation from the majority its historic range in the United States (Gaines and Laymon 1984, Hughes 1999, Halterman et al. 2001). In October 2014, the U.S. Fish and Wildlife Service formally recognized the western yellow-billed cuckoo as a threatened species under the Endangered Species Act with an estimated population of between 680 to 1,025 pair, with approximately half of the population in the U.S. and half in Mexico. This report details 2016 survey-based monitoring of the yellow-billed cuckoo population in the South Fork Kern River Valley, CA (KRV). The KRV presumably holds the second largest, and one of the last remaining breeding cuckoo populations in California. The main objective of this 2016 research was to estimate the local cuckoo occupancy and population size using cuckoo survey detections and territory estimates derived from four rounds of standardized surveys coupled with additional non-survey cuckoo observations.

In 2016, the Southern Sierra Research Station (SSRS) conducted broadcast surveys along eleven transects, four times each, from mid-June to early-August, surveying approximately 869 ha (2147 ac) of potentially suitable habitat. This included 264 ha (652 ac) of three- to six-year old Gooding's willow dominated habitat that has largely developed during the current six-year drought in the Lake Isabella drawdown zone. Surveyors recorded a total of 14 cuckoo detections, including one detection made in the relatively new drawdown zone habitat. This is down from total survey detections of 17, 43, and 89 respectively made in 2015, 2014, and 2012 (Stanek and Stanek 2012, Stanek 2014, Stanek and Stanek 2015). Based on the spatial distribution of the 2016 cuckoo observations, we estimate two probable territories established in the KRV. One territory consisted of a single cooing cuckoo detected on numerous occasions, continually soliciting for a mate, and suspected to have been unmated. A second probable territory was based on a pair of cuckoos detected together, coupled with two additional cuckoo detections made on subsequent surveys in the same area. At the Canebrake Ecological Preserve the California Department of Fish and

Wildlife conducted two rounds of cuckoo surveys in July and found no cuckoos. East of Sierra Way SSRS detected one cuckoo in our Central Valley Project Conservation Program (CVPCP) riparian enhancement and restoration area located on the Audubon Preserve. CVPCP habitat creation and restoration for cuckoos and other riparian species will begin in late fall 2016 and continue into 2020.

# *Introduction*

## *Yellow-billed Cuckoo History and Biology*

Over the last 100 years, the western yellow-billed cuckoo (cuckoo) population has declined dramatically following extensive loss of suitable breeding habitat, primarily riparian forests and associated bottomlands dominated by willow (*Salix* spp.), cottonwood (*Populus* spp.), or mesquite (*Prosopis* spp.) (Gaines and Laymon 1984, Laymon and Halterman 1987, Hughes 1999, Halterman et al. 2001). In the United States, extirpations and steady contraction of the cuckoo's breeding range has been regularly documented since the 1920's (Hughes 1999). Once considered a common breeder in California with an estimated 15,000 breeding pair (Hughes 1999), in less than 100 years the yellow-billed cuckoo has suffered severe population reductions (Grinnell and Miller 1944) and by 1987 was estimated at 40 pair occupying less than 30 percent of its historical range (Laymon and Halterman 1987, Hughes 1999). In recent years, the state population appears to have slightly increased due to the influx of cuckoos on the Lower Colorado River (Parametrix and SSRS 2016). However, across California the amount of occupied habitat appears to still be in decline. California statewide surveys conducted in 1977 (Gaines and Laymon 1984), 1986/1987 (Laymon and Halterman 1987), and 1999 (Halterman et. al 2001) found yellow-billed cuckoo populations in decline and concentrated mostly along the Sacramento River, the South Fork of the Kern River, and portions of the Lower Colorado River (LCR). The Sacramento River cuckoo population has since declined from 29 cuckoo pairs detected in 1977 to two possible territories detected in 2012. Eight detections were made in total, but only two sites had detections on multiple survey visits (Dettling et al. 2015). On the California side of the Lower Colorado River, in 1999, only two cuckoo pair were detected

(Halterman 2001), but restoration habitat planted in stages from 2006 – 2014 at the Palo Verde Ecological Reserve (north of Blythe, CA) by the Bureau of Reclamation Multi-Species Conservation Program has been exceptionally successful for cuckoos and in 2015 had 223 total cuckoo detections and 45 confirmed breeding territories (Parametrix and SSRS 2016). The KRV holds one of the largest remaining contiguous cottonwood/willow forests in the state of California (Gaines 1977), and is part of the proposed designated critical habitat for this species (USFWS 2014a). The area has been recognized as a consistent cuckoo breeding area for over 35 years (Gaines 1977, Laymon et al. 1997, Henneman 2009, Stanek and Stanek 2015) and the local population historically fluctuated between 2 to 24 pair, with an average of 11 pair (Laymon et al. 1997). Since the onset of the current drought affecting most of California, from 2012 – present, the estimated KRV cuckoo population has plummeted from eight estimated breeding territories (Stanek and Stanek 2012) down to 1 in 2016.

In 2001, the United States Fish and Wildlife Service (USFWS) formally recognized the western yellow-billed cuckoo population as a separate Distinct Population Segment (DPS) from the eastern cuckoo population, and a candidate for protective listing under the Endangered Species Act (USFWS 2001). In 2002, ESA listing was determined to be warranted but precluded by higher priority listing actions (USFWS 2002). In 2014 the USFWS officially recognized the western yellow-billed cuckoo DPS as a threatened species under the Endangered Species Act (USFWS 2014b).

Yellow-billed cuckoos are among the latest-arriving Neotropical migrants. They arrive on their breeding grounds in Arizona and California by June (Bent 1940, Hughes 1999). During the breeding season they forage primarily on large insects such as grasshoppers, katydids, caterpillars, mantids, and cicadas; but also on tree frogs and small lizards (Bent 1940, Hamilton and Hamilton 1965, Nolan and Thompson 1975, Laymon 1980, Laymon et al. 1997). Nesting usually occurs between late June and late July, but can begin as early as late May (Hughes 1999) and continue until late September (McNeil et al. 2013). Nests consist of a loose platform of twigs, which are built by both sexes and take one to two days to build (Hughes 1999), though occasionally, the nest of another species is used (Jay 1911, Bent 1940, Payne 2005). Cuckoos are facultative brood parasites, and when food resources are

plentiful females will raise their own young and may lay eggs in another yellow-billed cuckoo's nests (Nolan and Thompson 1975, Hughes et al. 1999). Clutch size is 1-5 (Payne 2005), though up to 8 eggs have been found in one nest due to more than one female laying in the nest (Bent 1940). Eggs are generally laid daily until clutch completion (Jay 1911), and incubation begins once the first egg is laid, lasting 9-11 days (Potter 1980, 1981; Hughes 1999). Young hatch asynchronously, are fed mostly large insects (Laymon and Halterman 1985, Laymon et al. 1997), and fledge after five to nine days (six days average). Fledglings may be dependent on adults for at least three weeks (Laymon and Halterman 1985).

Fall migration is thought to begin in August, with most birds gone by mid-September (Hughes 1999). Recent geolocator data from two cuckoos revealed that these birds had prolonged fall and spring migrations and overwintered in the Gran Chaco Region of South America (Sechrist et al. 2012, McNeil et al. 2015b).

# *Chapter 1. Detection/Non-Detection Surveys*

## *Introduction*

Long-term monitoring programs focus on the status and trends of species distribution, and can effectively document a species' annual state and changes in their condition through time. Through repeated surveys, the annual status of populations can be assessed by examining within-season distribution, occupancy, and abundance patterns, both spatial and temporal, across the landscape. In 2016, we continued our long-term monitoring of western Yellow-billed cuckoos (cuckoo) within the KRV to enable an annual status assessment of the species and to identify trends in cuckoo population parameters.

## *Methods*

Study Area and Survey Route Selection

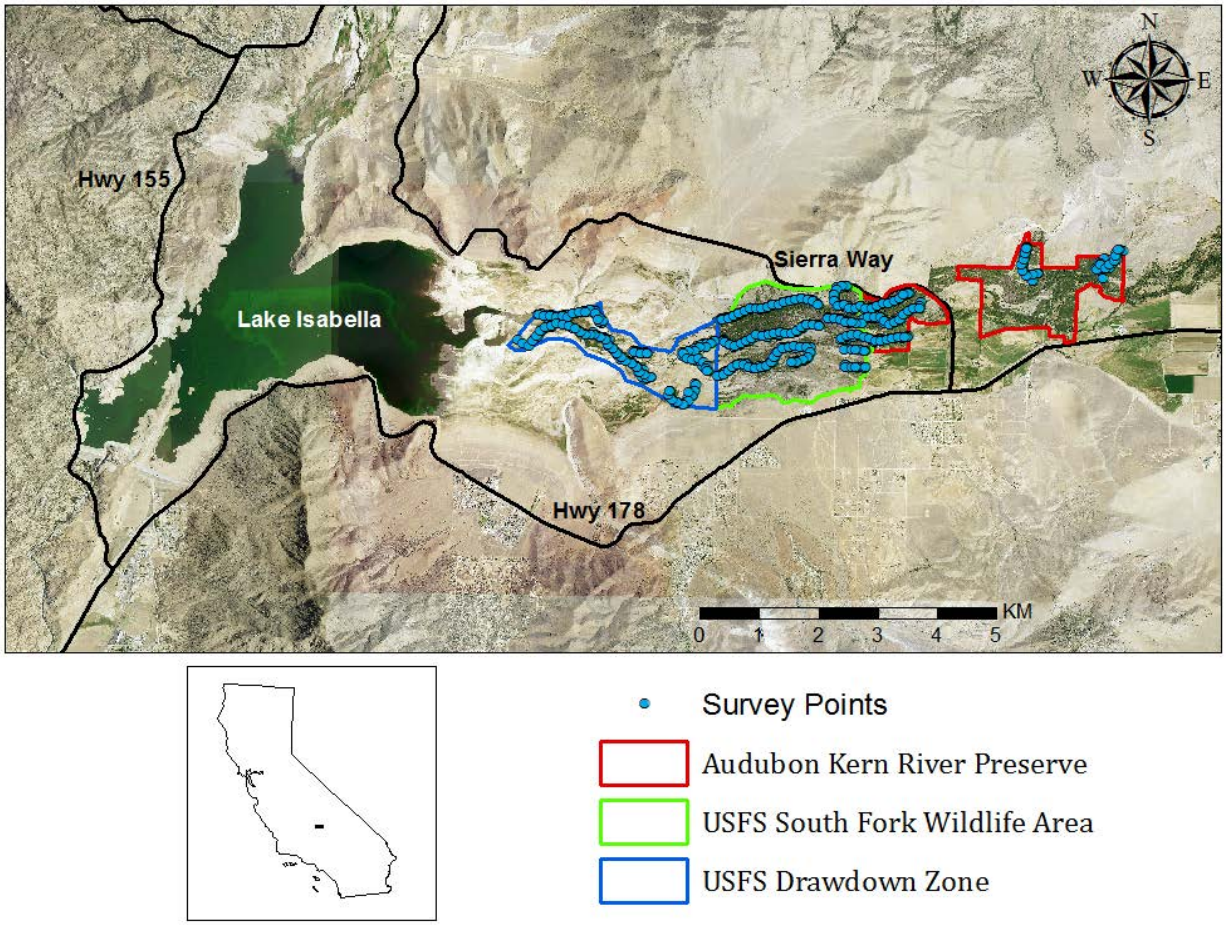
We conducted Yellow-billed Cuckoo surveys along eleven survey routes in Kern County, CA in the South Fork Kern River riparian area, primarily from Sierra Way west to the lake shore (Map a), covering approximately 814 ha (2011 ac) of potentially suitable breeding habitat. Habitat east of Sierra Way has experienced limited cuckoo activity in recent years and was last surveyed in 2012 (Henneman 2009, Whitfield and Stanek 2011, Stanek and Stanek 2012, Stanek 2014). In 2016, we conducted two surveys in this KRP habitat west of Sierra Way, at areas planned for habitat restoration starting in 2017. In the summer of 2015, Lake Isabella was at its lowest levels since 1977, at approximately 6% of capacity (32,558 acre-feet in August 2015/ 568,075 acre-feet pool maximum), which is lower than that depicted in the 2014 aerial image in Map a and Map b. In 2016 the eastern lake edge extended upstream to the east approximately two km from what is shown in Maps a and b. Note, the maximum full extent of the lake reaches the western Audubon property line, but our drawdown zone nomenclature references the habitat west of Patterson Lane, the western boundary of the USFS South Fork Wildlife Area.

The study area is dominated by young (USFS drawdown area) to mature (USFS Southfork Wildlife Area, Kern River Audubon Preserve) Gooding's Willow (*Salix goodingii*), Red

Willow (*Salix laevigata*), and Fremont Cottonwood (*Populus fremontii*). Primary understory vegetation includes stinging nettle (*Urtica dioica*), mulefat (*Baccharis salicifolia*), mugwort (Artemisia douglasiana), cocklebur (*Xanthium strumarium*), rabbit brush (*Chrysothamnus nauseosus*) and tamarisk (*Tamarix spp*.). Tamarisk is primarily found in the drawdown area.

The Kern River Audubon Preserve (KRP) and USFS South Fork Wildlife Area (SFWA) are dominated by a mature, 15 to 20 meter tall, riparian deciduous forest, estimated to vary between 30 to 40 years in age on average. The SFWA forest overstory is dominated by Gooding's Willow while the forest in the KRP is more diverse and dominated by red willow, Fremont cottonwood, with occasional velvet ash (*Fraxinus Velutinus*) and white alder (*Alnus rhombifolia*). Since 2012, the prolonged drought has led to significant decline in the overall health of the forest, ranging from the partial death of a majority of trees to widespread tree mortality. The understory, previously dominated by dense shrub and herbaceous cover, has died back significantly and is now better characterized as open and park-like or choked by dead vegetation and fallen trees.

In the USFS drawdown zone (map a), despite the continued drought (2012 to present), early successional habitat dominated by Gooding's willow and red willow emerged and thrived along the historical South Fork Kern River channel exposed by the receding lake. The trees are three to five years in age and two to eight meters tall. In 2016, rising lake levels inundated approximately one third to one half of this young habitat which led to the mortality of a significant number of trees, in particular red willow and scattered Fremont Cottonwood. We surveyed two transects within this young habitat (less than five years old) and mixed mature and young habitat found in this drawdown zone (Map a). Surveys of the inundated area were conducted by kayak. Two cuckoos were detected on surveys of this habitat in 2015 (Stanek and Stanek 2015). No cuckoos were detected here on 2014 surveys. (Stanek 2014).




Map a. Yellow-billed cuckoo survey locations in the Kern River Valley, Kern County, California, 2016.

## Detection/Non-detection Surveys

Occupancy and cuckoo detection totals were derived from standard detection, non-detection cuckoo surveys and are the standard metrics used to describe cuckoo survey results (Stanek and Stanek 2012, McNeil et al. 2013, Halterman et al. 2016). However, their secretive traits, variable responsiveness, and somewhat transitory behavior lead to a variable and imperfect detection of the species (McNeil et al. 2013) and reduce survey detection totals to be an imprecise index of abundance. Cuckoos are inherently secretive, avoid detection and call infrequently (Hamilton and Hamilton 1965, Halterman et al. 2016). Their responsiveness to call broadcast surveys appears to vary with their breeding stage (McNeil et al. 2013, SSRS unpublished data). Cuckoo behaviors such as large overlapping

home-ranges, polyandry, local movement, and within-season emigration or immigration also adds uncertainty in estimating cuckoo population estimates. In sum, estimating cuckoo abundance from survey data is difficult, and it is possible to both under count or over count the number of cuckoos actually present (Halterman et al. 2016). Efforts can be made to minimize counting errors, such as concurrently conducting surveys on adjacent transects, but overall, in light of these difficulties, cuckoo surveys are better suited to estimate cuckoo habitat occupancy rather than cuckoo abundance.

SSRS conducted four rounds of surveys (Table 1-1), along eleven survey routes, between June 21st and August 10th following the recommended cuckoo survey protocol (Halterman et al. 2016). On each survey route, one survey was conducted per survey visit and surveys were conducted every 12-14 days. The cuckoo detection, non-detection surveys were conducted along point transects on foot (ten) and by kayak (one), between sunrise and 10:30 am. Because of the close proximity of some survey routes, adjacent survey routes were surveyed by different observers concurrently, on the same day, at the same time, and in the same direction, to minimize the possibility of double-counting the same cuckoo. On these occasions, surveyors used text messages and hand-held radios to communicate with each other to avoid conducting call-broadcasts within 300m of a detected cuckoo, and double-counting detected cuckoos. We surveyed large habitat patches along two or three parallel transects spaced approximately 250 to 300m apart. As per the cuckoo survey protocol, survey points were spaced every 100 m along transects. Six transects traversed through the habitat patches, while the remaining five were conducted along riparian habitat edges to maintain a 250m buffer from adjacent transects and to take advantage of greater visual detectability from these edges. Survey points were located using Garmin GPS units and at each point we recorded the UTM location, date, and time.

Transects surveyed in 2016 were the same as those conducted in 2015 (Stanek and Stanek 2015), with two exceptions. In 2016, we conducted surveys along two new transects in the Audubon Kern River Preserve, east of Sierra Way, in our new CVPCP riparian habitat creation and restoration areas (Map a).

Table 1-1. Survey dates. The Survey Period numbering (column 2) follows the new format established in Halterman et al. 2016 and varies from the previous (pre-2015) Survey Period numbering format that utilized the same dates (column 3), but followed the Survey Visit numbering 1-4 (column 1). In this report, we discuss detection results relative to the Survey Visit to enable easy comparisons with pre-2015 cuckoo reports.

| Survey Visit | Survey Period | Dates |
|---|---|---|
| 1 | 1 | June 15th to June 31 |
| 2 | 2 | July 1 to July 15 |
| 3 | 2 | July 16 to July 31 |
| 4 | 3 | August 1 to August 15 |

We followed the survey protocol outlined by Halterman et al. (2016). Upon arriving at a survey point, surveyors listened and watched for cuckoos for one minute. If no cuckoos were detected, surveyors used an mp3 player and handheld speaker to broadcast a five-second yellow-billed cuckoo contact call (the 'kowlp' call) (Hughes 1999) at approximately 70 decibels once per minute for five minutes. A five-second contact call was followed by 55 seconds of active observation and listening. If a cuckoo was detected, call-playbacks were discontinued immediately and all pertinent data was recorded (see below). Following a detection, surveyors progressed along the point transect 300 m from the cuckoo's estimated location to conduct a new call-broadcast survey. This was done to avoid additional disturbance and duplicate detection of the same bird.

For each cuckoo detection, the surveyor recorded the true bearing and estimated distance from the surveyor to the cuckoo, time of detection, response type, behavior, vocalizations, presence of other cuckoos, interactions, and the presence and color combination of leg bands. Any observed breeding evidence was also recorded, including carrying food or nesting material, copulation, the presence of a juvenile, or a nest. An individual cuckoo visually observed or heard during a survey was recorded as a survey detection. If the same individual cuckoo was detected more than once during a single survey, we recorded only the initial detection as a new survey detection. Repeat detections were recorded and mapped, but not used in the final cuckoo survey detection summation. In general, cuckoos located >300 m apart during a single survey were counted as separate individuals (Halterman et al. 2016) and therefore separate survey detections. Cuckoos encountered

any time other than during a survey were classified as incidental detections. Information collected for an incidental detection was the same as that collected for a survey detection.

While surveys are best used to assess cuckoo occupancy, cuckoo territory estimation methods, based off spatial and temporal cuckoo detections, have been developed to help provide a population estimate. The territory estimation method evolved from a Breeding Bird Atlas breeding pair estimation method (Corman and Wise-Gervais 2005), have been refined over several years (Holmes et al. 2008, McNeil et al. 2013), and incorporated into the survey protocol (Halterman et al. 2016). Here we calculate cuckoo possible, probable and confirmed (Table 1-2) territory estimates using survey data coupled with additional non-survey cuckoo observations following Halterman et al. (2016).

Table 1-2. Cuckoo territory estimation methods from Halterman et al. (2016).

| Term | Definition |
|---|---|
| Possible breeding territory (PO) | Two or more total detections in an area during two survey visits and at least 10 days apart. For example, within a certain area, one detection made during Survey Period 2 coupled with another cuckoo detection made 10 days later, also during Survey Period 2, warrants a PO territory designation. |
| Probable breeding territory (PR) | Three or more total detections in an area during at least three survey visits and at least 10 days between each detection. Or PO territory plus YBCUs observed carrying food (single observation), carrying a stick (single observation), traveling as a pair, or exchanging vocalizations. |
| Confirmed breeding territory (CO) | Observation of copulation, stick carry to nest, carrying food (multiple observations), distraction display, nest, or fledgling. |

# *Results*

## Survey Detections

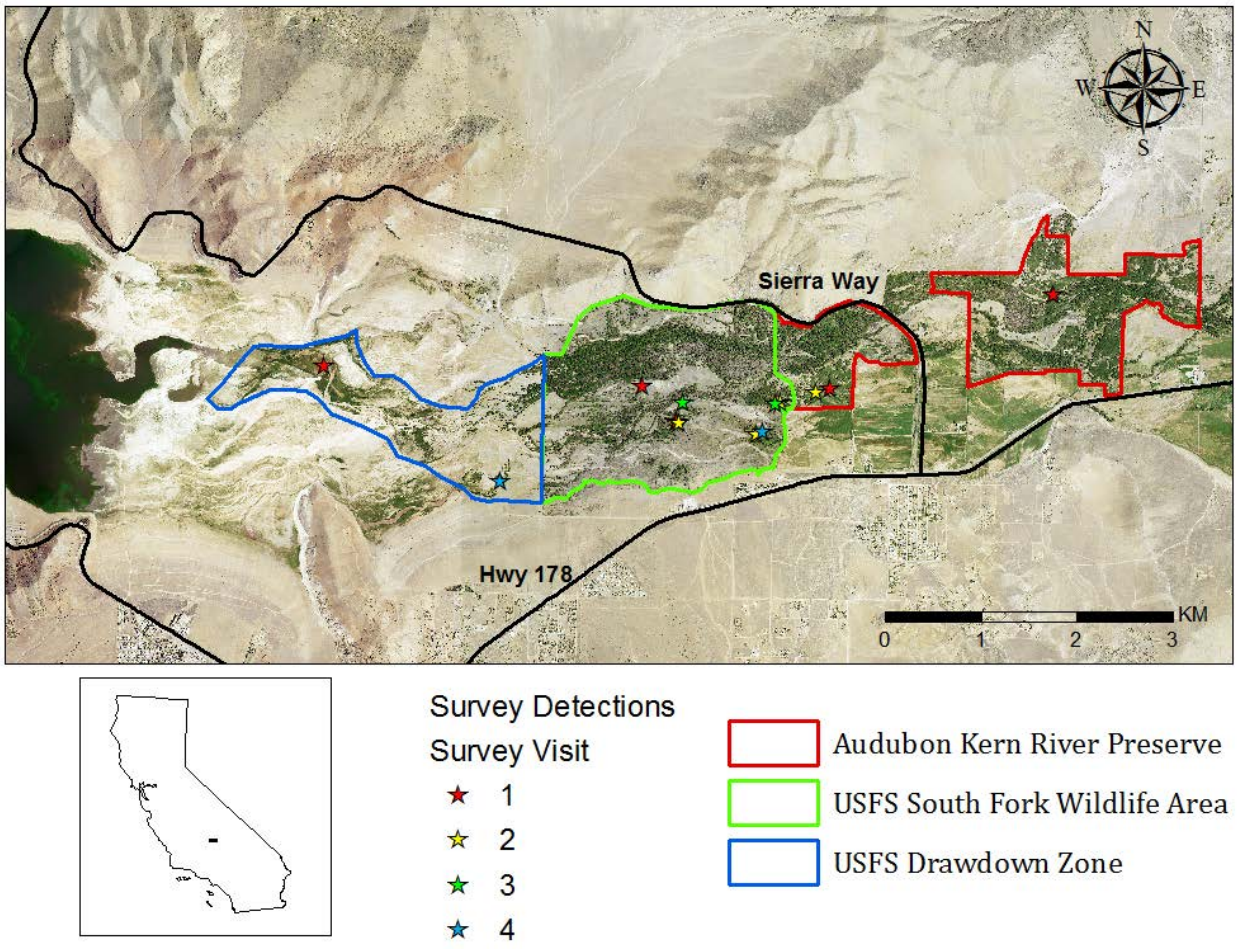
Four rounds of surveys conducted from June 21 to August 10, at 665 survey points, across nine survey routes, (Map a), yielded 14 Yellow-billed cuckoo detections (Map b). The Kern River Preserve, USFS South Fork Wildlife Area, and the USFS drawdown zone were all used by cuckoos, but most detections were concentrated in the USFS South Fork Wildlife Area (Table 1-3). One USFS drawdown zone detection was made in young four year old Gooding's willow habitat which at the time was under two to three feet of water (within 300m of the eastern 2016 lake edge extent). The second drawdown area detection was in

the vicinity of a 2014 nest location, in an area with a mix of young (less than five years old) and mature willow (*Salix goodingii*).

In addition to the surveys conducted by SSRS, the Department of California Fish and Wildlife conducted two July surveys at the Cane Brake Ecological Reserve; no cuckoos were detected.

Table 1-3. Yellow-billed cuckoo survey detections, 2016

| Area | Cuckoos Detected Per Survey Visit | | | | Total Survey Detections |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | |
| Kern River Audubon Preserve | 2 | 1 | 0 | 0 | 3 |
| USFS South Fork Wildlife Area | 3 | 3 | 2 | 1 | 9 |
| USFS Drawdown Zone | 1 | 0 | 0 | 1 | 2 |
| Total | 6 | 4 | 2 | 2 | 14 |




Map b. Yellow-billed cuckoo survey detections in the Kern River Valley, Kern County, California, 2016.

Territory Estimates

Territory estimates were made using survey and non-survey cuckoo observations. Areas with survey detections were revisited, often repeatedly, to search for cuckoo breeding evidence. We estimate two probable cuckoo territories in the study area in 2016. We did not observe any evidence of breeding. One territory consisted of a single cooing female cuckoo detected on numerous occasions, continually soliciting for a mate. The coo call is the cuckoo mate attraction signal given by the female (Halterman et al. 2016, SSRS unpublished data). This cooing bird traveled widely and utilized habitat with in the USFS Wildlife Area and Kern River Audubon Preserve. The second territory was based on a pair of cuckoos detected together, coupled with two additional cuckoo detections made on subsequent visits to the same area.

## *Discussion*

Similar to 2015, the extremely low number of observed cuckoos indicate that the KRV had few or even possibly no breeding resident cuckoos in 2016 (Table 1-3, Figure 1-1). The distribution of survey and follow-up cuckoo detections suggest that only two resident territories were established, and the continual cooing calls heard from one territory strongly implies that she was continually looking for a mate and likely did not breed. Since 2012, the KRV has experienced an 85% decline in the number of survey detections and a population decline from 13 estimated territories (Stanek and Stanek 2012) to two estimated territories in 2016. While, natural population fluctuations have been observed in the KRV in the past (Laymon et al. 1997), in context of the century-long population decline, with documented extirpations from British Columbia, followed by Washington, Oregon, and now possibly from the Sacramento River, the KRV population decline may be a symptom of the greater regional extirpation trend.

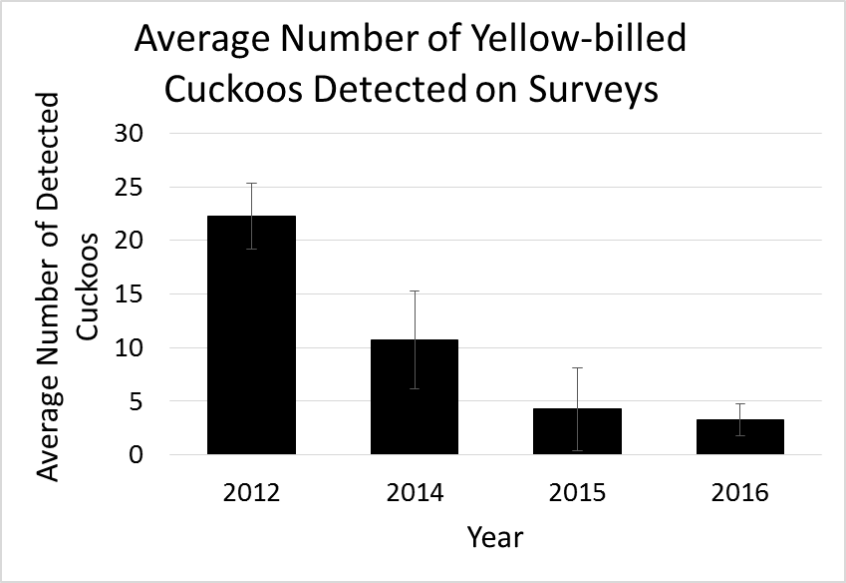



Figure 1-1. In the Kern River Valley, from 2012 to 2016 mean cuckoo detections declined by 85%, from 22.25 cuckoo detections per survey round in 2012 to 3.5 cuckoos detected per survey round in 2016. Averages are derived from four surveys per year and error bars depict standard deviations (Stanek and Stanek 2012, Stanek 2014, Stanek and Stanek 2015).

## *Management Recommendations*

Reasons for the continued decline of the western yellow-billed cuckoo are unclear. While habitat loss has been attributed as the major factor in the species decline (USFWS 2014b), it may not be the primary factor impeding its recovery. On the Sacramento River, over the last 30 years, habitat restoration has increased the amount of riparian forest in the valley, while at the same time the local cuckoo population continued to decline (Dettling 2015), and apparently suitable habitat remained unoccupied (Laymon and Halterman 1987, Dettling 2015). However, our ability to recognize habitat as suitable for cuckoos is difficult without some knowledge of the prey base that cuckoos depend upon in different regional areas. Monitoring food resources can provide vital insight into the causes of population changes (Visser and Both 2005). The resilience of the cuckoo's prey, large insects, frogs, and lizards, to potential local and regional impacts remains largely unstudied and unknown and as such, an evaluation of riparian habitat suitability for cuckoos remain incomplete.

In the KRV, the abundance and availability of caterpillars, tree frogs, and other prey items may be currently limited by the prolonged drought which has caused widespread tree mortality and understory changes within our study area. In other parts of the cuckoos' range, the relatively new but now commonly used neonicotinoid pesticides that have been shown to be lethal and sub-lethal to non-target invertebrate and avian species (Sánchez-Bayo 2014, Pisa et al. 2015), may be a potential threat to cuckoos. Food resources are critical habitat features rarely incorporated into any avian monitoring analysis and an assessment of the prey base would greatly increase our understanding of the habitat suitability for cuckoos and narrow the list of unknown factors contributing to the species continued decline. A region-wide, large insect study using targeted arboreal pheromone traps could be used to identify suitable riparian habitat throughout the cuckoos range.

Additional factors leading to the cuckoo decline may extend beyond the local conditions of their breeding habitat. Cuckoos spend only a brief period of their annual life cycle in the United States, approximately three months, with five months spent in their wintering grounds and another two months in migration each way (Sechrist et al. 2012, McNeil et al. 2015b). Because of this, an effective conservation strategy should target identifying the locations of, and threats to, migratory and winter habitat as the quantity and quality of this habitat may directly impact species survival and indirectly impact cuckoo reproductive success on their breeding grounds (Sherry and Holmes 1996, Norris et al. 2004, Studds and Marra 2007). At this time the migration habitat and wintering locations used by KRV cuckoos (and all yellow-billed cuckoos) remain largely unknown and we recommend that the identification of these locations using data loggers such as gps pinpoints be made a top cuckoo conservation priority.

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# *Literature Cited*


Bent, A. C. 1940. Life histories of North American cuckoos, goatsuckers, hummingbirds, and their allies. United States National Museum Bulletin No. 167, Washington, D.C.

Corman T.E., Wise-Gervais C., editors. 2005. The Arizona breeding bird atlas. UNM Press; Albuquerque, NM.

Dettling, M. D., N. E. Seavy, C.A. Howell and T. Gardali. 2015. "Current Status of Western Yellow-Billed Cuckoo along the Sacramento and Feather Rivers, California." PLoS ONE 10(4 ).

Gaines, D. 1977. Current status and habitat requirements of the Yellow-billed Cuckoo in California,: 1977 Endangered Wildlife Program, Nongame Wildlife Investigations, California Department of Fish and Game. Project E-1-1, Job IV-1.4.

Gaines, D., and S. A. Laymon. 1984. Decline, status and preservation of the Yellow-billed Cuckoo in California. Western Birds 15:49-80.

Grinnell, J. and A. Miller. 1944. The distribution of the birds of California. Pacific Coast Avifauna 18.

Halterman, M.D. 2001. Population Status of the Yellow-billed Cuckoo at the Bill Williams River NWR and Alamo Dam, Arizona, and southern Nevada: Summer 2000. Report to the Bureau of Reclamation, Lower Colorado River Office, Boulder City, NV.

Halterman, M.D., M.J. Johnson, J.A. Holmes and S.A. Laymon. 2016. A Natural History Summary and Survey Protocol for the Western Distinct Population Segment of the Yellow-billed Cuckoo DRAFT. U.S. Fish and Wildlife Techniques and Methods, 45 p.

Hamilton, W. J. III, and M. E. Hamilton. 1965. Breeding characteristics of Yellow-billed Cuckoos in Arizona. Proceedings of the California Academy of Sciences. Fourth Series 32:405-432.

Henneman, C. 2009. Yellow-billed Cuckoo surveys in the South Fork Kern River Valley in 2008. Report to the US Fish and Wildlife Service, Sacramento Office. Sacramento, CA.

Holmes, J., C. Calvo, and M.J. Johnson. 2008. Yellow-billed cuckoo distribution, abundance, habitat use, and breeding ecology in the Verde River watershed of Arizona, 2004–2005 Final Report. Admin Rept., Arizona Game and Fish Dept. 34pp.

Hughes, J. M. 1999. Yellow-billeLaympd Cuckoo (Coccyzus americanus). No 148 in A. Poole and F. Gill, editors. The Birds of North America, Inc. Philadelphia, PA. USA.

Jay, A. 1911. Nesting of the California cuckoo in Los Angeles County, California. Condor 13:69–73.

Laymon, S. A. 1980. Feeding and nesting behavior of the Yellow-billed Cuckoo in the Sacramento Valley. California Department of Fish and Game, Wildlife Management Branch, Sacramento, CA. Administrative Report 80-2.

Laymon, S. A., and M. D. Halterman. 1985. Yellow-billed Cuckoos in the Kern River Valley: 1985 population, habitat use, and management recommendations. Report to the Nature Conservancy. Sacramento, CA.

Laymon, S. A., and M. D. Halterman. 1987. Can the western subspecies of the Yellow-billed Cuckoo be saved from extinction? Western Birds 18:19-25.

Laymon, S. A., P. L. Williams, and M. D. Halterman. 1997. Breeding status of the Yellow-billed Cuckoo in the South Fork Kern River Valley, Kern County, California: Summary report 1985-1996. Prepared for USDA Forest Service, Sequoia National Forest, Cannell Meadow Ranger District.

McNeil, S. E., D. Tracy, J. R. Stanek, J. E. Stanek, and M. D. Halterman. 2011. Yellow-billed Cuckoo distribution, abundance and habitat use on the lower Colorado River and tributaries, 2010. Annual report to the U.S. Bureau of Reclamation, Multi-Species Conservation Program, Boulder City NV, by SSRS. www.lcrmscp.gov/reports/2010/d7_rep_10.pdf

McNeil, S. E., D. Tracy, J. R. Stanek, J. E. Stanek, and M. D. Halterman. 2013. Yellow-billed Cuckoo distribution, abundance and habitat use on the lower Colorado River and tributaries. 2008-2012 Summary report to the U.S. Bureau of Reclamation, Multi-Species Conservation Program, Boulder City NV, by SSRS.

McNeil, S. E., D. Tracy, J. Lisignoli and T. Hurt. 2015a. Yellow-billed Cuckoo Surveys and Population Monitoring on the Lower Colorado River and Tributaries, 2014 Annual Report. Summary report to the U.S. Bureau of Reclamation, Multi-Species Conservation Program, Boulder City NV, by Parametrix, Inc., and SSRS.

McNeil, S. E., D. Tracy, and C. D. Cappello. 2015b. Loop Migration and Chaco Wintering by a Western Yellow-billed Cuckoo. Western Birds 46(3).

Nolan, V. N .Jr, and C. F. Thompson. 1975. The occurrence and significance of anomalous reproductive activities in two North American non-parasitic cuckoos Coccyzus spp. Ibis 117:496–503.

Norris, D. R., Marra., P. P. , Kyser, T. K., Sherry, T. W., and L. M. Ratcliffe. 2004. Tropical winter habitat limits reproductive success on the temperate breeding grounds in a migratory bird. Proceedings of the Royal Society of London B: Biological Sciences 271: 59-64.

Parametrix, Inc., and Southern Sierra Research Station. 2016. Yellow-billed Cuckoo Surveys and Population Monitoring on the Lower Colorado River and Tributaries, 2015 Annual Report. Prepared by D. Tracy and S.E. McNeil, Southern Sierra Research Station, Weldon, California, and Parametrix, Inc., Albuquerque, New Mexico. Submitted to the Bureau of Reclamation, Boulder City, Nevada. February 2016.

Payne, R. B. 2005. The Cuckoos. Oxford University Press. Oxford, UK.

Pisa, L. W., Amaral-Rogers, V., Belzunces, L. P., Bonmatin, J. M., Downs, C. A., Goulson, D., Kreutzweiser, D. P., Krupke, C., Liess, M., and M. McField. 2015. "Effects of neonicotinoids and fipronil on non-target invertebrates." Environmental Science and Pollution Research. 22: 68-102.

Potter, E. F. 1980. Notes on nesting Yellow-billed Cuckoos. Journal of Field Ornithology 51:17-28.

Potter, E. F. 1981. Effects of cool weather on nesting behavior and development in the Yellow-billed Cuckoo. Chat 45:15-16.

Sánchez-Bayo, F. 2014. The trouble with neonicotinoids. Science 346: 806-807.

Sechrist, J., Paxton, E. H., Ahlers, D., Doster, R. H., and Ryan, V. M. 2012. One year of migration data for a Western Yellow-billed Cuckoo. Western Birds 43:2–11.

Sherry, T. W. and R. T. Holmes 1996. Winter Habitat Quality, Population Limitation, and Conservation of Neotropical-Nearctic Migrant Birds. Ecology 77: 36-48.

Stanek, J. R., and J. E. Stanek. 2012. Yellow-billed Cuckoo Occupancy, Breeding, and Habitat Use in the South Fork Kern River Valley, 2012 Annual Report. Report to the US Fish and Wildlife Service, Sacramento Office, Sacramento, CA.

Stanek, J. R. 2013. Yellow-billed Cuckoo Occupancy, Breeding, and Habitat Use in the South Fork Kern River Valley, 2013 Annual Report.

Stanek, J. R. 2014. Yellow-billed Cuckoo Occupancy, Breeding, and Habitat Use in the South Fork Kern River Valley, 2014 Annual Report.

Stanek, J. R., and J. E. Stanek. 2015. Yellow-billed Cuckoo Occupancy, Breeding, and Habitat Use in the South Fork Kern River Valley, 2015 Annual Report.

Studds, C. E. and P. P. Marra 2005. Nonbreeding habitat occupancy and population processes: an upgrade experiment with a migratory bird. Ecology 86: 2380-2385.

United States Fish and Wildlife Service (USFWS). 2001. Endangered and threatened wildlife and plants; 12-month finding for a petition to list the Yellow-billed Cuckoo (Coccyzus americanus) in the western continental United States. Federal Register 66:38611-38626.

United States Fish and Wildlife Service (USFWS). 2002. Yellow-billed Cuckoo candidate listing on Endangered Species List. Federal Register 67:40657- 40679.

United States Fish and Wildlife Service (USFWS). 2014a. Designation of critical habitat for the western distinct population segment of the Yellow-billed Cuckoo; Proposed rule. Federal Register 79:48547-48652.

United States Fish and Wildlife Service (USFWS). 2014b. Determination of threatened status for the western distinct population segment of the Yellow-billed Cuckoo (*Coccyzus americanus*). Federal Register, 79: 59991-60038.

Visser, M. E. and C. Both. 2005. Shifts in phenology due to global climate change: the need for a yardstick. Proceedings of the Royal Society of London B: Biological Sciences 272: 2561-2569

Whitfield, M. J. and J. R. Stanek. 2011. Yellow-billed Cuckoo Surveys in the South Fork Kern River Valley in 2010. Prepared for U.S Fish and Wildlife Service Sacramento Office.